BELT CLEANING SPROCKET

RELATED APPLICATION

This application is based on and claims the benefit of prior filed co-pending provisional patent Application No. 60/200,793, filed Apr. 28, 2000.

FIELD OF THE INVENTION

This invention relates to sprockets used with endless conveyors, and especially to sprockets which are adapted to clean the conveyor when in operation.

BACKGROUND OF THE INVENTION

Conveyors comprising sprocket driven endless belts are used in a wide spectrum of industrial applications to transport items being manufactured or processed from point to point. The items being transported may leak or ooze liquids of varying viscosity, or shed dust, dirt, particles or debris which can accumulate on the belt and foul the conveyor.

This problem is especially acute in meat processing equipment where cuts of meat are transported on conveyors between processing stations and ooze blood, deposit viscous or congealed fat, cartilage, muscle, and other animal carcase liquids and debris onto the belt. Such organic matter cannot be allowed to accumulate on the conveyor because it quickly decays and presents a health hazard, rendering the conveyor unusable to transport meat for human consumption.

While it is a relatively simple matter to wash the outside surface of the conveyor on which the meat is supported to remove any accumulated organic matter, the various liquids and soft debris tend to work their way into and through crevasses, joints, hinges, interfaces and openings in the belt and a substantial amount of unwanted organic matter thereby accumulates on the inside surface of the belt and on the drive components such as the drive sprockets, idler sprockets and support rollers. Generally, the inside surface of the belt and the drive components are not easily accessible for cleaning, requiring that the conveyor be regularly shut down and maybe even partially disassembled to effect a thorough cleaning and removal of the accumulated organic matter.

There is clearly a need for a conveyor wherein the inside surface can be easily and regularly cleaned to remove unwanted debris, liquids, dust and dirt, especially when such debris comprises organic matter which can decay and foul the conveyor.

SUMMARY AND OBJECTS OF THE INVENTION

The invention concerns an endless conveyor for transporting items and is particularly suited (although not limited) to use in the meat processing industry. Preferably the conveyor comprises at least two rotatably mounted sprockets having respective axes of rotation parallel to one another and arranged in spaced relation along a path oriented perpendicularly to the axes. An endless belt is carried by the sprockets along the path, the endless belt having an outwardly facing surface for supporting the items, such as cuts of meat, and an inwardly facing surface opposite the outwardly facing surface. The inwardly facing surface engages the sprockets.

Preferably, at least one of the sprockets comprises an elongated body having an outer surface for support of the inwardly facing surface of the belt. A fluid conduit extends lengthwise within the body from one end. The one sprocket has a pair of supports for rotatably mounting the body, one of the supports having a fluid inlet communicating with the fluid conduit. A plurality of outlet passages extend from the fluid conduit and terminate in apertures in the outer surface of the body. The inlet passage supplies fluid under pressure to the fluid conduit and the fluid, preferably a cleaning liquid, flows outwardly through the outlet passages and the apertures onto the inwardly facing surface of the endless belt where it cleans that surface.

Preferably, the length of the one sprocket is substantially equal to the width of the belt, and the fluid conduit extends from the one end substantially to the other end of the body. This configuration allows the outlet passages and the apertures to be positioned in spaced relation lengthwise along the body, thus, ensuring that the entire width of the belt is subjected to the cleaning spray of fluid flowing out of the apertures.

While the sprocket may be used with almost any type of conveyor, it is especially effective when used with an endless belt which comprises a plurality of segments arranged side by side. The segments are hingedly connected to one another allowing them to pivot relative to each other when traversing around a sprocket. Because of the many hinges and joints required to ensure flexibility such belts have a marked tendency to accumulate debris on their inside surface as well as other normally inaccessible places such as in the joints between the segments. Cleaning sprockets as described above are particularly suited for use with segmented hinged belts and provide a convenient way to keep the entire belt clean without the need to bring the conveyor out of service for routine cleaning.

The sprocket spraying the fluid can be positioned anywhere along the belt path where it can engage the belt's inwardly facing surface to effectively clean the belt. For example, the sprocket could take the form of a support roller having a smooth outer cylindrical surface and be positioned somewhere between the ends of the belt. Preferably, the sprocket is a driver or an idler positioned at an end of the belt run where the belt segments pivot relatively to one another as they traverse the sprocket and transition to the return leg of their path.

To function effectively as a driver, it is preferable that the sprocket have a plurality of teeth spaced circumferentially around the body projecting radially outwardly to engage the inwardly facing surface of the belt. The belt preferably has a plurality of mating teeth projecting from its inwardly facing surface. The mating teeth on the belt interengage the teeth projecting from the body and allow the sprocket to turn without slipping relatively to the belt and impart the force to the belt necessary to drive it. To accommodate the belt at the end of the run and provide a smooth transition around the sprocket, the tips of the teeth intersect a common imaginary cylindrical support surface which envelops the sprocket.

To ensure that the spray covers the entire inwardly facing surface of the belt, the apertures are arranged in a row extending in a helix lengthwise along and around the cylindrical support surface. The helix arrangement helps to distribute the fluid spray evenly across the width of the belt and ensures that the belt is receiving a continuous spray of fluid across its width and not an intermittent burst, as would occur if the apertures were arranged in a straight line along the sprocket's length.

When the sprocket has teeth to engage the belt, it is preferable to position the apertures in between the teeth, thus, allowing the spray to clean the teeth as well as the belt. Furthermore the region in between the teeth normally does

not come into contact with the belt, thus, allowing a continuous spray to be emitted from the apertures under a constant pressure. If the apertures were periodically blocked by contact with the belt, as they might be if located elsewhere on the sprocket, it would cause repeated pressure surges within the fluid conduit, changing the spray pattern and placing unnecessary stress on the various fluid handling components.

To more effectively control the fluid spray, it is preferable to fit nozzles within the apertures. Nozzles can be used to point the spray in a particular direction onto the belt, for example, perpendicularly or relatively tangentially to the inwardly facing surface. Nozzles can also be used to increase the impact force of the fluid stream by directing it into a jet to effectively dislodge stubborn particles or into a diffuse spray to envelop the entire inwardly facing belt surface as required for a particular application. Preferably, the nozzles are oriented substantially radially with respect to the long axis of the body.

It is an object of the invention to provide an endless conveyor wherein the inside surface can be easily and regularly cleaned.

It is another object of the invention to provide an endless conveyor which does not require disassembly to effect cleaning.

It is yet another object of the invention to provide a sprocket for a conveyor through which a fluid can be sprayed onto the inside surface of the conveyor to effect cleaning.

These and other objects of the invention will become apparent from a consideration of the following drawings and detailed description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of an endless conveyor according to the invention;

FIG. **2** is a perspective view of a sprocket according to the invention shown in FIG. **1**;

FIG. **3** is sectional view taken along line **3**—**3** in FIG. **2**;

FIG. **4** is a cross-sectional view taken along line **4**—**4** of FIG. **2**;

FIG. **5** is a partial cross-sectional view of the sprocket shown in FIG. **2**;

FIG. **6** is a cross-sectional view of an alternate embodiment of the sprocket shown in FIG. **2**; and

FIG. **7** is a cross-sectional view of another alternate embodiment of the sprocket shown in FIG. **2**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** shows an endless conveyor **10** according to the invention, the conveyor having an endless belt **12** suspended between two rotatably mounted sprockets **14** and **16**. Belt **12** has an outwardly facing surface **18** on which the items to be transported by the belt are supported and an inwardly facing surface **20** opposite the surface **18** and engaging sprockets **14** and **16**. Belt **12** is preferably made of a plurality of segments **22** arranged side by side and hingedly connected to one another by hinge pins **24** allowing segments **22** to pivot relative to one another when traversing around sprockets **14**, **14***b* and **16** as shown at positions **26** in FIG. **1**. Preferably, segments **22** have mating teeth **28** projecting from the inwardly facing surface **20** to engage teeth on sprockets **14**, **14***b* and **16** described below. As noted above, sprocket **14** could be an idler sprocket, a driver sprocket, a support roller such as **14***a* in FIG. **1**, positioned to engage inwardly facing surface **20** of belt **12** at intermediate points along its run or a belt tensioning sprocket **14***b* positioned at a loop of belt **12** to interact with a pair of tensioning rollers **27** to facilitate tensioning of the belt.

FIG. **2** shows a detailed perspective view of sprocket **14** which preferably comprises an elongated body **30** having an outer surface **32** for support of inwardly facing surface **20** of belt **12**. Surface **32** may be a cylindrical surface as seen at **14***a* in FIGS. **1** and **6** where the sprocket frictionally engages the inwardly facing surface **20** to provide support of the belt along its run. However, when used as an idler or a driven sprocket surface **32** is preferably formed by a plurality of teeth **34**, the tips **36** of the teeth being coincident with an imaginary cylindrical surface **31** enveloping the sprocket (shown in dashed line in FIG. **4**). Teeth **34** are sized and shaped to engage mating teeth **28** on the inwardly facing surface **20** of belt **12** and permit the sprocket to rotate without slipping relatively to the belt. This is most efficient when the sprocket is used as a driver but is also useful when the sprocket is an idler or a support roller as it ensures that the sprocket rotates whenever the belt rotates, the significance of which is explained below.

As shown in FIG. **3**, a fluid conduit **38** extends lengthwise within the elongated body **30** from one end **40** and preferably substantially to the other end **42**. As best shown in FIG. **4**, a plurality of outlet passages **44** extend from the fluid conduit **38** and terminate in apertures **46** in an outer surface **47** of the body **30**.

As shown in FIGS. **2** and **3**, sprocket **14** has a pair of supports **48** and **50**, which extend from the ends of the sprocket allowing it to be rotatably mounted, for example in a pair of journal bearings (not shown). One of the supports, for example **48**, has a fluid inlet passage **52** extending through it and communicating with fluid conduit **38** by means of openings **54**.

Fluid, supplied under pressure to fluid inlet passage **52** through a suitable coupling (not shown) flows through the inlet passage into the fluid conduit **38**, through the outlet passages **44** and exits through apertures **46** where the spray contacts the inwardly facing surface **20** of belt **12** to dislodge any debris or residue which has formed on the surface.

To ensure that the belt receives the effect of the cleaning spray over the entire width, it is preferable that the width of the sprocket be substantially the same as the width of the belt and that the fluid conduit **38** extend substantially from one end of the sprocket **40** to the other end **42**.

Preferably, fluid outlet passages **44** are positioned in spaced relation lengthwise along body **30**, and more preferably, the outlet passages are arranged in a row extending in a helix lengthwise along and around the cylinder as shown in FIGS. **2** and **3**. Arranging the outlet passages along the entire length ensures that the fluid and its cleansing action will be distributed over the entire width of the belt, and arranging the outlets in a helix ensures that the belt is receiving a continuous spray of fluid across its width and not an intermittent burst, as would occur if the apertures were arranged in a straight line along the sprocket's length. Sprocket teeth **34** engaging mating teeth **28** on belt **12** ensure that the sprocket rotates without slipping relatively to the belt and as the sprocket rotates it is constantly directing a different stream of fluid at a different portion of the belt for maximum cleaning coverage.

As a practical matter, the supports **48** and **50** may be mounted at the ends of a continuous axle **55** which extends entirely through the fluid conduit **38**. To seal the body **30** at